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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/909,265	07/19/2001	Anthony Vernon Walker Smith	15-979	9891

27667 7590 02/07/2006

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EXAMINER	
LI, SHI K	

ART UNIT	PAPER NUMBER
2633	

DATE MAILED: 02/07/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/909,265	SMITH ET AL.	
	Examiner	Art Unit	
	Shi K. Li	2633	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08 December 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-37* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-37* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. Claims 1-25 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claim 1 recites the limitation "with and without regeneration" in line 7 of the claim. The specification as originally filed does not teach the limitation in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Therefore, it is considered as new subject matter.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

3. Claims 1, 3-4, 16, 19-20 and 34-36 are rejected under 35 U.S.C. 102(a) as being anticipated by Kim et al. (S. Kim et al, "Regenerator Placement Algorithms for Connection Establishment in All-Optical Networks", IEE Proc-Commun., Vol. 148, No. 1, February 2001).

Regarding claims 1 and 36, Kim et al. teaches a method for establishing a connection in a WDM network. Kim et al. teaches connection request in p. 26, right col., first paragraph. Kim et al. teaches in FIG. 1 a path which is equivalent to a "link path" of instant application. By placing regenerators in different nodes as taught in page 26, left col., Kim et al. teaches a

plurality of routes equivalent to "viable regenerator paths" as defined by the instant specification. Kim et al. then teaches to use dynamic programming to compute cost of viable regenerator paths. Finally, Kim et al. teaches to choose the path with minimal cost for the connection (see p. 27, Section 2.1, *Problem Formulation Using Dynamic Programming*).

Regarding claims 3-4, Kim et al. teaches to select path based on occupation cost.

Regarding claim 16, Kim et al. teaches in Table 3 to order the viable regenerator paths in a matrix according to the number of regenerators (K regenerators are used in stage K).

Regarding claim 19, Kim et al. teaches engineering a plurality of routes between a source and a destination node for selecting a best route. Kim et al. teaches in page 26, right col., third paragraph to assign wavelength to each fragment independently and, therefore, assign a set of wavelengths to each route.

Regarding claim 20, Kim et al. suggest in Section 4 that calls (lightpaths) are setup for those calls that are not blocked.

Regarding claim 34, Kim et al. teaches in Section 4 evaluation of various regenerator placement algorithms on a 25-node bidirection ring network. Kim et al. teaches maintaining status of regenerators and wavelengths (e.g., FIG. 3 shows the results of a network with 16 regenerators and 8 wavelengths). When a call request arrives, available resources are located for setup a lightpath. If resources are not available, the call is blocked.

Regarding claim 35, Kim et al. teaches in Eq. (1) to evaluate BER for regenerator paths and engineer regenerator paths such that they all meet BER requirements.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 2, 5-9, 11, 26-28 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Banerjee et al. (D. Banerjee et al., "A Practical Approach for Routing and Wavelength Assignment in Large Wavelength-Routed Optical Networks", IEEE Journal of Selected Areas in Communications, Vol. 14, No. 5, June 1996) in view of Kim et al. (S. Kim et al, "Regenerator Placement Algorithms for Connection Establishment in All-Optical Networks", IEE Proc-Commun., Vol. 148, No. 1, February 2001).

Regarding claim 2, Banerjee et al. teaches to find a route given a source and a destination. Banerjee et al. teaches to use extended breadth-first search which terminates after it has found a desired number of alternate link paths (see p. 904 right col., first paragraph). The difference between Banerjee et al. and the claimed invention is that Banerjee et al. does not teach engineering each link path to determine the placement of regenerators. Kim et al. teaches to use dynamic programming to compute cost of each viable regenerator path as discussed above in regard to claims 1, 3-4, 16, 19-20 and 34-36. One of ordinary skill in the art would have been motivated to combine the teaching of Kim et al. with the wavelength routing method of Banerjee et al. because establishing connection under impairments such as ASE noise and crosstalk, optical signal may need to be regenerated at intermediate nodes for maintaining a BER below a certain level (see page 25, left col., first paragraph of Kim et al.). Thus it would have been

obvious to one of ordinary skill in the art at the time the invention was made to engineer viable regenerator paths for each link path, as taught by Kim et al., in the wavelength routing method of Banerjee et al. because establishing connection under impairments such as ASE noise and crosstalk, optical signal may need to be regenerated at intermediate nodes for maintaining a BER below a certain level. Note that Kim et al. teaches in Eq.(2) H-1 groups of routes, one for each value of R, and evaluates the cost for each group of routes.

Regarding claim 5, breadth-first search uses a path search tree.

Regarding claim 6, extended breadth-first search terminates after it has found a desired number of alternate paths.

Regarding claim 7, it is well known in search tree method to abandon branches that are unlikely to give satisfactory result.

Regarding claim 8, Banerjee et al. teaches in p.904, left col., last paragraph to reduce the number of variables by eliminating links that are not pass through. It is obvious to also eliminating nodes that are not pass through and include link and node that must pass through to further reduce the number of variables.

Regarding claim 9, Banerjee et al. minimizes the hops (cost) of the path.

Regarding claim 11, it is obvious that if a breadth-first search reaches all its leaves, the algorithm terminates.

Regarding claims 26-28 and 30, it is obvious to include routing module, regenerator placement module, wavelength assignment module and control unit for implementing the modified regenerator placement method of Kim et al. and Banerjee et al.

6. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kim et al. (S. Kim et al, "Regenerator Placement Algorithms for Connection Establishment in All-Optical Networks", IEE Proc-Commun., Vol. 148, No. 1, February 2001).

Kim et al. has been discussed above in regard to claims 1, 3-4, 16, 19-20 and 34-36. The difference between Kim et al. and the claimed invention is that Kim et al. does not teach to declare a best path when an aggregate occupation cost above a threshold. However, it is obvious that at each stage, the smallest number in the row can be considered as a threshold. If an aggregate occupation cost at the destination node of an earlier stage is less than the threshold, the corresponding path is the best. For example, in Table 3, since the aggregate occupation cost at node 10 of stage 5 is 1.588 and is less than any number in row of stage 6, the corresponding path is the best. One of ordinary skill in the art would have been motivated to declare a viable regenerator path as best without completing the whole calculation in the method of Kim et al. because such approach shortens the calculation time and establishes connection quickly. Thus it would have been obvious to one of ordinary skill in the art at the time the invention was made to declare a best path without completing the calculation cost for all possible paths in the method of Kim et al. because such approach shortens the calculation time and establishes connection quickly.

7. Claims 29 and 31-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kim et al. and Banerjee et al. as applied to claims 2, 5-9, 11, 26-28 and 30 above, and further in view of Jukan et al. (A. Jukan et al., "Service-Specific Resource Allocation in WDM Networks with Quality Constraints", IEEE Journal on Selected Areas in Communications, Vol. 18, No. 10, October 2000).

Kim et al. and Banerjee et al. have been discussed above in regard to claims 2, 5-9, 11, 26-28 and 30. The difference between Kim et al. and Banerjee et al. and the claimed invention is that Kim et al. and Banerjee et al. do not teach user defined performance constraints. Jukan et al. teaches that service-specific connection requests has become increasingly important and in setting up lightpath connections, quality-of-service (QoS) must be taken into consideration (see p.2051, left col., first paragraph. Jukan et al. presents in FIG. 1 a generic approach and in Section III algorithms for wavelength routing and resource allocation. One of ordinary skill in the art would have been motivated to combine the teaching of Jukan et al. with the modified method of Kim et al. and Banerjee et al. and include user defined performance constraints in selecting paths because lightpath for difference services requires different QoS and if the QoS of a path does not meet the user requirement it cannot be accepted for providing service. Thus it would have been obvious to one of ordinary skill in the art at the time the invention was made to include user defined performance constraints in addition to cost, as taught by Jukan et al., in selecting path in the modified method of Kim et al. and Banerjee et al. because lightpath for difference services requires different QoS and if the QoS of a path does not meet the user requirement it cannot be accepted for providing service.

Regarding claims 31 and 33, Jukan teaches to take into consideration QoS (user defined performance and cost constraints) in setting up lightpaths.

Regarding claim 32, Kim teaches in Eq. (1) to use BER for evaluate regenerator paths. BER is an indication of signal quality.

8. Claim 37 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kim et al. (S. Kim et al, "Regenerator Placement Algorithms for Connection Establishment in All-Optical

Networks", IEE Proc-Commun., Vol. 148, No. 1, February 2001) in view of Levandovsky et al. (U.S. Patent Application Pub. 2002/0063915 A1).

Kim et al. has been discussed above in regard to claims 1, 3-4, 16, 19-20 and 34-36. The difference between Kim et al. and the claimed invention is that Kim et al. does not teach to evaluate paths based on an end-to-end performance parameter. Levandovsky et al. teaches in FIG. 3 to evaluate path based on its BER. One of ordinary skill in the art would have been motivated to combine the teaching of Levandovsky et al. with the method of Kim et al. because a path cannot be used to provide service unless its BER is within an acceptable range. Thus it would have been obvious to one of ordinary skill in the art at the time the invention was made to evaluate paths based on its BER to select a best path, as taught by Levandovsky et al., in the method of Kim et al. because a path cannot be used to provide service unless its BER is within an acceptable range.

Allowable Subject Matter

9. Claims 10, 12-15, 18 and 21-25 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

Response to Arguments

10. Applicant's arguments filed 8 December 2005 have been fully considered but they are not persuasive.

The Applicant argues that Kim does not disclose or suggest the engineering of such routes as is required by claims 1, 3-4, 16, 19, 20 and 36. Applicant argues that FIG. 1 clearly

shows a single route which may contain a plurality of nodes. In response, the Examiner provides an extensive explanation below.

FIG. 1 shows a lightpath comprising a plurality of regeneration nodes. Kim teaches on page 26, left col. that the lightpath from source node *a* to destination node *b* is engineered based on BER requirement (see Eq. 1). By placing regeneration at different nodes, a number of routes are obtained. Kim uses a fragment vector $\mathbf{h}=(h_1, h_2,\ldots, h_k)$ to denote a route. It is true that FIG. 1 shows a single route, i.e., $\mathbf{h}=(h_1=2, h_2=4, h_3=7)$ as pointed out by Applicant and admitted by Kim (see paragraph between Eq.1 and Eq.2). However, Kim teaches that by taking different fragment vectors, one gets a plurality of routes. For example, a fragment vector **h**=(1,2,3,4,5,6,7,8,9) means a route with a regeneration at each node between source *a=0* and destination *b=10*. Applying the notation of Kim to instant specification, the first path of FIG. 5B is $\mathbf{h}=(h_1=C)$, the second path of FIG. 5B is $\mathbf{h}=(h_1=B, h_2=C)$ and the 5th path of FIG. 5B is $\mathbf{h}=(h_1=B, h_2=C, h_3=D)$. Although Kim does not use the exact same language as instant claim, the method taught by Kim is the same as the method claimed by instant claim.

Furthermore, Eq. (2) of Kim teaches H groups of routes where H is the number of hops. That is, Eq.(2) teaches 10 groups of routes for a 10-hop lightpath. Kim lists in Table 2 the result of engineering the 10 groups corresponding to the lightpath of FIG. 1. Row 1 (stage 1) corresponds to R=1, i.e., only one regenerator in the route; row 2 (stage 2) corresponds to R=2, i.e., two regenerators in the route; etc. This is the same approach as FIG. 5B of instant claim except that Kim uses a table instead of a diagram. Kim teaches on page 27, right col., first paragraph that the optimal route under given conditions is $\mathbf{h}=(h_1=1, h_2=4, h_3=6, h_4=8)$ with

minimum cost of 1.590, and the route with minimum number of regenerator is $\mathbf{h}=(h_1=3, h_2=6, h_3=8)$.

Based on the above explanation, the Examiner concludes that Kim teaches "engineering a plurality of routes between a source node and a destination node" as recited in claim 1.

The Applicant argues that Kim does not disclose or suggest claims 34 and 35. The Examiner disagrees. Kim et al. teaches in Section 4 evaluation of various regenerator placement algorithms on a 25-node bidirection ring network. Kim et al. teaches maintaining status of regenerators and wavelengths (e.g., FIG. 3 shows the results of a network with 16 regenerators and 8 wavelengths). When a call request arrives, available resources are located for setup a lightpath. If resources are not available, the call is blocked. Kim et al. teaches in Eq. (1) to evaluate BER for regenerator paths and engineer regenerator paths such that they all meet BER requirements.

Regarding claims 2, 5-9, 11, 26-28 and 30, the Applicant argues that Kim nor Banerjee, taken separately or in combination, neither suggest the construction of 'n' valid link paths connecting a source node and destination node nor the configuration of 'm' groups of routes corresponding to the respective associated link path, as in claim 2. The Examiner disagrees. Banerjee et al. teaches to use extended breadth-first search which terminates after it has found a desired number (e.g., 'n') of alternate link paths (see p. 904 right col., first paragraph). Kim et al. teaches in Eq.(2) H groups of routes, one for each value of R, and evaluates the cost for each group of routes.

The Applicant argues that the problem of wavelength assignment and regenerator configuration are not synonymous and a technique used to assign wavelengths to a given path

would not be used by one of ordinary skill in the art to assign regenerators, or vice versa. However, the Examiner does not suggest that wavelength assignment and regenerator configuration are synonymous. The rejection suggests that wavelength assignment and regenerator configuration are complementary steps in determining lightpaths in WDM network. For example, Kim cites on page 25, left col., first paragraph references [1-3] (which have been listed as prior art in form PTO-892 dated 2/7/2005). These are all papers for wavelength routing. Therefore, it is understood that the work of Kim is built on top of wavelength routing. That is, wavelength routing determines a lightpath and Kim teaches assignment of regenerators on this lightpath for meeting BER requirements.

Regarding claim 29, the Applicant argues that neither Kim nor Banerjee discloses or suggests "user defined performance and cost constraints", as is required by claim 29. However, Jukan et al. teaches service-specific connection requests. One cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). .

Conclusion

11. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period

will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shi K. Li whose telephone number is 571 272-3031. The examiner can normally be reached on Monday-Friday (8:30 a.m. - 5:00 p.m.).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jason Chan can be reached on 571 272-3022. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

skl
31 January 2006

Shi K. Li
Patent Examiner